A METHOD FOR FABRICATING A SEMI-HERMETIC SCROLL COMPRESSOR AND ITS STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to a method for fabricating a semi-hermetic scroll compressor and its structure, especially to the method for fabricating the structure of the semi-hermetic scroll compressor being by way of assembling a plurality of sub-casings with fixing design therein and fewer compressor elements and providing a function of quality control as well.

2. Description of the Prior Art

Please refer to Figure 1, which is a sectional view of a hermetic scroll compressor in prior arts. A casing 10' of the compressor adopts steel to be structured by way of welding. Components inside the casing are piled up, therefore, it is known that the components being installed in the casing 10' shall be in sequence from a bottom of the compressor to a top of the compressor, and then to weld the casing 10' for enclosing.

As it can be seen in the Figure 1, the components are mainly accumulated in the casing 10' in sequence as a lower bearing 13', a motor stator 16', a motor rotor 17', a drive shaft 18' with an eccentric crank pin 23', an upper counterweight 19', a bearing base 21', a main bearing 14', a lower counterweight 20', an upper bearing 15', a brace 24', an orbiting scroll member 25', a fixed scroll member 26', a partition plate 31', a floating seal 30' and a discharging port 34'. A motor base 11', a lubricant tank 12', a boss 22', plural compressing chambers 27', 28' and 29', a high-pressure passage 32', a high-pressure chamber 33' and plural lubricant channels 35' are naturally formed while aforesaid accumulated components being assembled.

The following will describe in detail for the relationships of the components. Firstly, to offer a lower part of the casing 10', and the motor base 11' and the lubricant tank 12' are initially shaped in the lower part of the casing 10'. Then the motor stator 16' and the motor rotor 17' are installed in as a motor part in the compressor. The drive shaft 18' is assembled with the lower bearing 13', the main bearing 14', the upper counterweight 19' and the lower counterweight 20' in the lower part of the casing 10'. Of course, the bearing base 21' is put together as well in the step. The brace 24' is fit in for accepting the orbiting scroll member 25' and the fixed scroll member 26' continuously, and therefore the two scroll members being mounted on. Meanwhile, the boss 22' of the orbiting scroll member 25' surround with the eccentric crank pin 23' of the

drive shaft 18'. Obviously, the orbiting scroll member 25' is driven by the drive shaft 18' via the eccentric crank pin 23', and the structures of the orbiting scroll member 25' and the fixed scroll member 26' are corresponded together to have the plurality of compressing chambers 27', 28' and 29', which achieve high pressure while the orbiting scroll member 25' being in motion to decrease volumes of the compressing chambers. The partition plate 31' is then covered on a top of the lower part of the casing 10' with the floating seal 30'. The floating seal 30' functions to prevent leaking, therefore the high-pressure passage 32' is configured and to let compressed high-pressure vapor refrigerant pass through. Finally, to weld an upper part of the casing 10' is to form the high-pressure chamber 33' for containing the high-pressure vapor refrigerant. Meantime the discharging port 34' is mounted also while fixing the upper part of the casing 10'. Furthermore, some lubricant channels are configured on relevant components for lubricant going back to the lubricant tank 12' and avoiding to bring lubricant back into the high-pressure chamber 33' via inlet refrigerant. Hence, an important issue is extended, which is that the components are accumulated while in assembly, and how to accurately connect two adjacent components for configuring a lubricant channel or channels is a must for technical consideration.

Up to now, there are some problems being raised as following since relative relationships among the motor part, including the drive shaft 18', the motor stator 16' and the motor rotor 17', the bearing part, including the lower bearing 13', the main bearing 14' and the upper bearing 15', and others being made, especially an eccentric distance for the eccentric crank pin 23' generated by the scroll structure:

1. The components are piled up, and therefore each component with its own precisions of dimensions, locations, etc. must be very accurate. Therefore the time for manufacturing will be longer comparatively.

2. The prior art has only one positioning portion for a stand height, that is, the motor base 11', other components are thus accumulated thereon. Obviously, almost all of the components must be positioned so as to that causing harder and longer assembly.

3. Welding causes high temperature to further affect the dimensional precisions of distances between components, each component and the casing 10'. Hence, the quality control is difficult to approach or the clearance between each component should be enlarged to cover the dimensions of each component due to high temperature.

4. All of the components are already in machining before installing, and consequently some places for two or more components accumulated together may be more precise by requests, hence the precision being asked is raised to cause longer assembly time.

As aforesaid, to develop another type of compressor to solve those problems becomes an

important issue in the field.

SUMMARY OF THE INVENTION

The main objective of the present invention is to offer a method for fabricating a semi-hermetic scroll compressor and its structure to adopt a plurality of suitable portions on several sub-casings of the semi-hermetic scroll compressor for sectional positioning standards. Therefore, firstly the precisions may not be lost while in installment. Logically, the number of components in the semi-hermetic scroll compressor is not as many as prior arts', and secondly the assembly time is proportional down.

The other objective of the present invention is to offer a method for fabricating a semi-hermetic scroll compressor and its structure to accept different fastening way for combining the plural sub-casings rather than welding. It is that no more high temperature effect being generated.

Other and further features, advantages and benefits of the invention will become apparent in the following description taken in conjunction with the following drawings. It is to be understood that the foregoing general description and following detailed description are exemplary and explanatory but are not to be restrictive of the invention. The accompanying drawings are incorporated in and constitute a part of this application and, together with the description, serve to explain the principles of the invention in general terms. Like numerals refer to like parts throughout the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects, spirits and advantages of the preferred embodiments of the present invention will be readily understood by the accompanying drawings and detailed descriptions, wherein:

Fig. 1 is a sectional view of a hermetic scroll compressor in prior arts.

Fig. 2 is a sectional view of a first preferred embodiment of the present invention.

Fig. 3 is a sectional view of a second preferred embodiment of the present invention.

Fig. 4 is a flow chart of a method of the first preferred embodiment of the present invention.

Fig. 5 is a flow chart of a method of the second preferred embodiment of the present

invention.

Fig. 6 is a top view of a shoulder with continuous of the present invention.

Fig. 7 is a top view of a shoulder with discontinuous of the present invention.

Fig. 8 is a sectional view of plural lubricant channels of the first preferred embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 2, which is a sectional view of a first preferred embodiment of the present invention. Normally, the embodiment is divided by two parts, an upper casing 10 and a lower casing 40, and most of components are installed and configured in the lower casing 40. There are two designs for originally shaped in the lower casing 40 for installing height standards and bringing lubricant back to where it is from, one is a fixing bearing portion 11 and a fixing bearing base portion 36 of fixing design and another is plural lubricant channels 35 of lubricant design. That is, to help the precisions for positioning being not lost while the components in installment and inlet gas refrigerant being not mixed with lubricant then brought into compressing chambers.

The structure of the semi-hermetic scroll compressor comprises: a plurality of sub-casings with fixing design and lubricant design, the fixing design and the lubricant design are initially configured on at least one internal surface of the plurality of sub-casings, the sub-casings include the upper casing 10 and the lower casing 40, the upper casing 10 has a high-pressure chamber 33 of a high-pressure device and a partition plate 31 of a partition device being equipped in the upper casing 10 for separation; the lower casing 40 has the fixing bearing base portion 36 and the fixing bearing portion 11 of the fixing design both being initially configured on an internal surface of the lower casing 40 as standard heights for positioning, the plurality of lubricant channels 35 of the lubricant design being initially configured on the internal surface of the lower casing 40, an upper bearing 15, a main bearing 14, a lower bearing 13, a brace 24 and a bearing base 21 of a fixing device being equipped in the lower casing 40 and cooperating with the fixing design for positioning, a drive shaft 18, a motor stator 16 and a motor rotor 17 of a driving device being equipped in the lower casing 40 and positioned by the fixing design and the fixing device, a fixed scroll member 26 and an orbiting scroll member 25 of a compressing device being equipped in the lower casing 40 and positioned by the fixing design and the fixing device, further that, the compressing device being driven by the driving device, and a lubricant tank 12 of a lubricant device, wherein the driving device drives the compressing device to achieve high-pressure vapor refrigerant into the high-pressure chamber 33 separated by the partition plate

31, the lubricant tank 12 in a bottom of the lower casing 40 pumps some lubricant to lubricate while the driving device being in motion; wherein the structure further include an upper counterweight 19, a lower counterweight 20 and a discharging port 34.

The drive shaft 18 is driven by the motor rotor 17, thus an eccentric crank pin 23 on a top of the drive shaft 18 being wrapped around by a boss 22 of the orbiting scroll member 25 generates a centrifugal force to make the orbiting scroll member 25 and the fixed scroll member 26 produce rotary motion. A plurality of compressing chambers 27, 28 and 29 increase the refrigerant pressure by reducing the volume of the chambers to compress the gas refrigerant into the high-pressure chamber 33 via a high-pressure passage 32, because a switching valve 30 will guide the high-pressure refrigerant toward the high-pressure chamber 33 while operating and change the direction of refrigerant to the chamber in lower casing while in compressor shut-off. Surely, the pumped gas refrigerant will be delivered with high speed through the discharging port 34.

The high-pressure chamber 33 is with the immersed type 101 which makes high pressure side without connecting with outer surface of compressor, that is, the upper casing 10 totally covers the partition plate 31 for avoiding any the condition of leakage and exploding danger to operator.

Referring to Fig. 3, which is a sectional view of a second preferred embodiment of the present invention. The structure of the semi-hermetic scroll compressor comprises: a plurality of sub-casings with fixing design and lubricant design, the fixing design and the lubricant design are initially configured on at least one internal surface of the plurality of sub-casings, the sub-casings include an upper casing 60, a middle casing 89 and a lower casing 90, the upper casing 60 has a high-pressure chamber 83 with immersed type of a high-pressure device and a partition plate 81 of a partition device being equipped in the upper casing 60 for separation; the middle casing 89 has a radial fixing scroll member portion 87, an axial fixing scroll member portion 86, a fixing motor portion 88 of the fixing design being initially configured on an internal surface of the middle casing 89 as standard heights for positioning, the plurality of lubricant channels 85 of the lubricant design being initially configured on an internal surface of the middle casing 89, an upper bearing 65, a main bearing 64 of a fixing device being equipped in the middle casing 89 and cooperating with the fixing design for positioning, a drive shaft 68, a motor stator 66 and a motor rotor 67 of a driving device being equipped in the middle casing 89 and positioned by the fixing design and the fixing device, a fixed scroll member 76 and an orbiting scroll member 75 of a compressing device being equipped in the middle casing 89 and positioned by the fixing design and the fixing device, further that, the compressing device being driven by the driving device; the lower casing 90 has a lower bearing 63 of the fixing device, the plurality of lubricant channel 85 of the lubricant design being initially configured on an internal

surface of the lower casing 90, a fixing bearing portion 61 of the fixing design and a lubricant tank 62 of a lubricant device, wherein the driving device drives the compressing device to generate high-pressure vapor refrigerant into the high-pressure chamber 83 separated by the partition plate 81, the lubricant tank 62 in a bottom of the lower casing 90 provides some lubricant to lubricate while the driving device being in motion; wherein the structure further include a upper counterweight 69, a lower counterweight 70 and a discharging port 84.

The drive shaft 68 is driven by the motor rotor 67, thus a eccentric crank pin 73 on a top of the drive shaft 68 being wrapped around by a boss 72 of the orbiting scroll member 75 generates a centrifugal force to make the orbiting scroll member 75 and the fixed scroll member 76 produce rotary motion. A plurality of compressing chambers 77, 78 and 79 increase the refrigerant pressure by reducing the volume of the chambers to compress the gas refrigerant into the high-pressure chamber 83 via a high-pressure passage 82, because a switching valve (not shown in the Figure) will guide the high-pressure refrigerant toward the high-pressure chamber 83 while operating and change the direction of refrigerant to the chamber in lower casing while in compressor shut-off. Surely, the pumped gas refrigerant will be delivered with high speed through the discharging port 84.

The high-pressure chamber 83 is with the immersed type 601 which makes high pressure side without connecting with outer surface of compressor, that is, the upper casing 60 totally covers the partition plate 81 for avoiding any condition of leakage and exploding danger to operator.

Referring to Fig. 4, which is a flow chart of a method of the first preferred embodiment of the present invention. For constructing the first preferred embodiment, the method comprises:

1. having an upper casing 10 and a lower casing 40 with fixing design and lubricant design, wherein the upper casing 10 further includes a high-pressure device (a high-pressure chamber 33 with immersed type and discharging port 34) and the partition device (a partition plate 31), the lower casing 40 further includes the fixing design (a fixing bearing base portion 36 and a fixing bearing portion 11) as standard height for positioning, the lubricant design (plural lubricant channels 35) for bringing lubricant back to a lubricant device, the fixing device (an upper bearing 15, a main bearing 14, a lower bearing 13, a brace 24 and a bearing base 21), the driving device (a drive shaft 18, a motor stator 16 and a motor rotor 17), the compressing device (a fixed scroll member 26 and an orbiting scroll member 25), the lubricant device (a lubricant tank 12) and a counterweight device (an upper counterweight 19 and a lower counterweight 20), the fixing design and the lubricant design being initially configured inside at least one internal surface of the lower casing 10;

2. cooperating with the fixing design to compose of the fixing device, the driving device, the

compressing device and the partition device in the upper casing 10 and the lower casing 40;

3. adopting bolts and nuts to tighten the upper casing 10 and the lower casing 40, and the two casings can be disassembled for service needs;

4. finishing the method.

Referring to Fig. 5, which is a flow chart of a method of the second preferred embodiment of the present invention. For constructing the second preferred embodiment, the method comprises:

1. having an upper casing 60, a middle casing 89 and a lower casing 90 with fixing design and lubricant design, wherein the upper casing 60 further includes a high-pressure device (a high-pressure chamber 83 with hiding type) and a partition device (a partition plate 81), the middle casing 89 further includes the fixing design (a radial fixing scroll member portion 87, an axial fixing scroll member portion 86 and a fixing motor portion 88) as standard height for positioning, the lubricant design (plural lubricant channels 85) for bringing lubricant back to a lubricant device, the fixing device (an upper bearing 65 and a main bearing 64), the driving device (a motor stator 66, a motor rotor 67 and a drive shaft 68), the compressing device (a fixed scroll member 76 and an orbiting scroll member 75) and a counterweight device (an upper counterweight 69), the lower casing 90 further includes the fixing device (a lower bearing 63), the fixing design (a fixing bearing portion 61), the lubricant device (a lubricant tank 62) and the counterweight device (a lower counterweight 70), the fixing design and the lubricant design being initially configured inside at least one internal surface of the sub-casings;

2. cooperating with the fixing design to compose of the fixing device, the driving device, the compressing device and the partition device in the upper casing 60, the middle casing 89 and the lower casing 90;

3. adopting bolts and nuts to tighten the upper casing 60, a middle casing 89 and a lower casing 90, and the three casings can be disassembled for service needs;

4. finishing the method.

The aforesaid two embodiments adopt the casting to figure the casings, and positioning and standard planes for assembling are ready after machining, therefore the following advantages are made:

1. To control better inner clearance with the same machining precision as prior arts: due to the ways of welding and accumulating components to assembly, the inner clearances for prior arts

may be design to enlarge; on the other hand, the present invention should not have the two factors so as to that having better precision.

2. Easily assembling the components to make conditions of shorter manufacturing time, fewer components and less accumulated tolerance: a relationship between the positioning and the assembling can be made while casting and forming the casings, hence the required components is less.

3. Lowering down the factors for affecting precisions: to accept multiple sections of the casing and to fasten the multiple sub-casings with screws.

4. Lowering down the machining cost: some components or portions of the sub-casings being not precise, such as lubricant channels, may adopt the way of casting to form.

5. Highly decreasing noise and vibration while running: due to the cast casing being with the plurality of fixing portions while the casing configured initially, thus the components to be positioned are totally less than prior arts' to result the noise reduced, and the cast casing is with the feature of anti-vibration.

Referring to Fig. 6 and Fig. 7, which are top views of a shoulder with continuous and discontinuous. Shoulder is defined as a standard assembling and positioning plane, so it can be as a continuous type, a shoulder 4 in Fig. 4; or a discontinuous type, a shoulder 5 in Fig. 5. The two types of shoulders are designed to have components thereon for being as standard planes. It is then greatly decreasing required precisions, cost, the complexity of assembling and accumulated tolerance.

Referring to Fig. 8, which is a sectional view of plural lubricant channels of the first preferred embodiment. Lubricant is pump up to the location among the boss 22, the eccentric crank pin 23, the orbiting scroll member 25, the fixed scroll member 26 and some other related components from the lubricant tank 12 along with the drive shaft 18 for lubrication, after that, lubricant channel 35 being initially formed while the casing being shaped provides a passage for bringing lubricant back to the lubricant tank 12. As a result, lubricant channel stays away from the chance for mixing lubricant and gas refrigerant

Although this invention has been disclosed and illustrated with reference to particular embodiments, the principles involved are susceptible for use in numerous other embodiments that will be apparent to persons skilled in the art. This invention is, therefore, to be limited only as indicated by the scope of the appended claims.